

NICE³ Technical Periodic Report #3

1. Title / State / Company

Precision Irrigation Technologies for the Agricultural Industry
Colorado Office of Energy Management and Conservation
Colorado Corn Administrative Committee

2. Periodic Activity Summary - In a narrative format, briefly describe the technical progress for the period.

The baseline energy, environmental, and economic metrics have been completed.

The ultimate goal of much of the technical progress accomplished to date is to evaluate the variabilities of each field and delineate these areas as different management zones. Thus far, project personnel have developed a baseline of soil data (through Veris information and soil samples) to determine what the management zones in each field should be. Partners have also completed the yearly evaluations of the soil tests, the yearly irrigation water management reports, and the computer reports of well tests and water management. The project has also completed yearly soil compaction, water filtration, and fertilizer management studies. At this time the management zones could be described as "rough." As personnel continue to do field evaluation through the growing season and gather more data using aerial imagery, field scouting, yield mapping, and soil sampling, the project will be able to fine tune these management zones.

In another area of significant technical progress, laboratory testing of a single span AccuPulse system, using a new configuration of the accumulator, was completed. Discharge uniformity was found to be much better than that of the previous design.

Progress on the web site, kiosk, brochure, and video has been initiated.

3. Milestone Table

a) Describe technical progress for the period, with ongoing activities and discuss the actions taken to meet the milestone deadlines.

Development of the baseline energy, waste, and economic metrics have been completed in collaboration with the Colorado Office of Energy Management and Conservation and the Department of Energy Golden Field Office.

Servitech selected and sampled soil test points within the management zones for each field. Soil samples were analyzed at Servi-Tech laboratories in Hastings, Nebraska. The data from these samples were fed into SST toolbox software to generate maps for individual crop nutrients as

well as organic matter and PH levels. Generalized fertilizer recommendations have been made from the soil sample data. Herbicide recommendations have been made based on estimated weed pressures. The Wiggins site was planted in onions in late March and Servitech has been making weekly field checks since that time. The Yuma site had not been planted as of this report.

Y-W Well Testing conducted well tests, took soil samples, and installed soil moisture blocks.

Quality Irrigation installed the Agri-Inject Pro units at both demonstration sites in March. In early May, project personnel from Quality Irrigation lowered the Accu-Pulse system at the Wiggins demonstration site and checked the operation. The only repair work need was the replacement of one plastic pipe fitting that had frozen and split.

Based on previous laboratory tests, Valmont has redesigned the accumulator and obtained a new supplier for the components of AccuPulse. A single span of this new design has been tested in the lab to determine the uniformity of both solution volume and solution concentration as a function of both time and space. Coefficient of variation was found to be less than 6 percent so long as operating pressure was maintained above 55psi.

A datalogger installed on the Wiggins center pivot sprinkler has collected data on system operation for the early 2001 season, including a record of the precise time of start and stop of each tower for use in the simulation program. The field at Wiggins on which the system is installed has been planted to onions and the crop is emerged at this time. Instruments are being installed in preparation for field data collection during the 2001 growing season. The system at Yuma will be planted to corn within the next few days, depending on weather conditions, and field data collection will begin shortly thereafter.

Colorado Corn has coordinated the development of a site plan for the web site, including internal and external links. Refinement and final appearance of the site is being reviewed for consistency with other project promotional materials. Photos, art and graphics are being reviewed, needed materials are being identified, and graphics planned toward the development of the project kiosk. Planning is in process toward the development and distributions of the video, including scripting to best depict the entire scope of the project. The brochure development is underway with the gathering of appropriate technical, marketing and visual materials. Planning is in process to insure consistency of style, color, and design of visual aspects of all promotional tools.

b) Provide an explanation of technical difficulties encountered while testing, installing, or operating the system.

Y-W Well Testing had difficulties getting a water pumping level at the Yuma site.

The AccuPulse system as designed can apply a maximum of 23.6 gallons of chemical solution per acre. The farmer who is growing onions on the system at Wiggins in 2001 requires 50 gallons of solution per acre. The limiting factor on gallons per acre flow rate is the recharge time required for each set of accumulators vs. the speed the tower moves. If a set of accumulators does not completely fill before it tries to pulse it will shut down the center pivot. The shut down

would be a safety measure to assure the end of the set would have the correct amount of solution applied. Valmont is not sure whether the AccuPulse system will adequately refill at the necessary 4.5 second pulse interval (as designed, it pulses every 9 seconds), therefore is unwilling to accept liability for uniformity of chemical application at this faster pulse rate.

c) Explain the steps taken to resolve these difficulties.

Y-W Well Testing contacted the landowner at the Yuma site and he agreed to make another access location to establish water pumping levels.

Quality Irrigation met with partners from USDA and the grower at the Wiggins demonstration site to review the operation of the Inject Pro unit. USDA has obtained the necessary equipment to reprogram the PLCs on the Wiggins AccuPulse system to obtain the application rate desired by the farmer. Project personnel will so reprogram and test the uniformity at the more rapid pulse rate to assure that the chemical application uniformity is satisfactory.

d) Describe any known or potential changes in milestone dates.

N/A

e) Address activities and planned accomplishments for the upcoming quarter.

The upcoming quarter encompasses the majority of the 2001 growing and field data collection season. Activities include:

Servitech will continue to make weekly field checks to assess plant growth as well as weed, insect, and disease infestations.

Y-W Well Testing will evaluate soil moisture blocks weekly into September.

Quality Irrigation will continue to troubleshoot and fine-tune the Accu-Pulse equipment throughout the project.

USDA will collect field data to compare the uniformity of chemical application by AccuPulse, by ground sprayer, and by aerial application using water sensitive papers and computer image analysis. The design layout for this comparison has been completed and supplies have been procured. At Yuma, corn will be planted, and a similar field distribution study will be conducted to compare AccuPulse with ground application. Further studies will be conducted at Yuma to determine the vertical distribution through the crop canopy as a means of comparing the efficacy of pesticides applied.

4. Discuss results (testing etc.) and their implications to the project. Discuss any necessary or anticipated milestone additions or deletions.

At this time, Servitech has found that there is quite a lot of variability in soil fertility levels. The Accupulse system, once fully functional, will be able apply variable rates of fertilizer to more accurately meet the needs of these variable levels of nutrients. Servitech expects to find that weed and insect pressures will also vary across the field throughout the growing season.

The soil moisture blocks installed by Y-W Well Testing show that the demonstration site hosts could still fine-tune water use for the season.

Quality Irrigation is trying a different lifting system at the Yuma site. This new approach should allow the accumulators to be lifted higher, eliminating any potential water pattern interference.

As a result of laboratory testing that showed the uniformity of the previous design was poor, Valmont redesigned the accumulator and obtained a new fabricator with higher quality control standards. The resulting product delivers a much more uniform volume of chemical solution.

5. Attach publications written that relate to the project (internally or externally produced). List any planned publications or conferences to be attended related to the project for the next quarter.

The baseline energy, waste, and economic metrics summary and charts are attached.

Servitech's soil test results and recommendation reports for the two demonstration sites are attached.

Y-W Well Testing's soils/root investigation reports, soil compaction study results, irrigation management worksheets, and irrigation system evaluation reports for the two demonstration sites are attached.

USDA produced the following publication, which is attached:

Farahani, H.J. and G.W. Buchleiter. 2001. Low volume chemical application system. Central Plains Irrigation Short Course, Kearney, NE. February 2-5.

USDA will attend the following conferences during the next quarter:

Farahani, H.J. 2001. Modeling spatial distribution of agricultural chemicals using the AccuPulse system. ASAE Paper 01-2022. Amer. Society of Agrl. Engrs., Sacramento CA. (July 29-Aug 1, 2001)

Buchleiter, G.W., H. Farahani and G. Bartlett. 2001. Evaluation of low-volume chemical application system. ASAE Paper 01-2164. Amer. Society of Agrl. Engrs., Sacramento CA. (July 29-Aug 1, 2001)

6. Discuss any key personnel changes (including state, cost-share, subgrantee, and others involved).

Technician Conrad Bauer is no longer with Y-W Well Testing, and Devin Ridnour (a recent Colorado State University graduate) has joined Y-W's water management team.

7. Discuss any cost-sharing partner/demonstration partner changes.

N/A

8. Discuss any other topics that are relevant to the scope and progress of the project.

The project continues to enjoy widespread interest among local, regional, and national agricultural and scientific communities.

Colorado State University is exploring precision agriculture technology at the two demonstration sites, and this summer project personnel will share field scouting and aerial imagery information.

This past quarter, Y-W Well Testing attended the Greeley Farm Show, Corn Grower banquet, and Northeast Colorado Youth Water Festival. Project personnel from Y-W are also on the Northeast Water Quality Committee and the Ogallala Aquifer Symposium Committee.

The complete project team continues to meet, discuss results, and plan for the coming year.